

letters

States Embassy in Paris refused to grant Professor Vigier a visa. Professor Vigier is a world authority on the subject of causality in physics, in which Albert Einstein was interested and Louis de Broglie and other leading physicists continue to be interested.

I suggest that you should pay some attention to violations of human rights of this sort by the United States government.

LINUS PAULING

Linus Pauling Institute of Science and Medicine

2/7/79

Menlo Park, California

Computer program support

The letter by E. N. Maslen (February, page 9) regarding the poor judgment shown in fund allocation for computer programs for crystallography and chemistry was timely and persuasive. An aspect of computer use in scientific work that he didn't include may help understand the reason for this lack of appreciation he criticized. This is that computer work by a research-oriented scientist (as opposed to a computer-oriented mathematician) is, for the more sophisticated codes, extremely complex and time consuming. Long problem trial turn-around time, frequent changes in coding rules and in-out format with active software groups, the human-error factor and the difficulty of finding errors once made all serve to reorient the attention from physics to programming methods.

A remarkably capable theoretical crystallographer I knew several years ago was in the computer room every time I was, and I worked 16 hours a day for 3 years on a laser problem. Since his work was abundantly recognized in the Citation Index, I inferred that his own support problem was not due to its quality, nor to the lack of recognition of his work in the world of science. More probably, it was the excessive demands on his time and energy when supporting active experimental groups by theoretical methods using the computers. The frequent required justification of one's work, perhaps impossible where theory occasionally conflicts with appropriate measurements, may be the more basic reason for the lack of appreciation of the real usefulness of some computer programs.

C. B. MILLS

2/19/79

Santa Fe, New Mexico

As a physicist who has become involved in writing application software, I heartily concur with E. N. Maslen's letter. In nuclear and particle physics useful software becomes widely dispersed and implemented on a variety of machines. These programs are normally written in

FORTTRAN and are more or less transportable depending upon local FORTRAN enhancements by the originator.

It is possible to produce programs which are more efficient in terms of size and speed while maintaining transportability. To take a simple example, suppose a programmer wishes to set an array of a given size to zero. The programmer would normally set up a DO loop and explicitly set each element in the array to zero. An alternative would be to invoke a subroutine, written in the assembler of the local machine, that has been optimized. This subroutine (called, say, VZERO) would, given the array name and the size of the array, set the entire array to zero in a more efficient manner than the code produced by most compilers. If we could all agree that this subroutine was to be called VZERO and further agree upon the sequence of its arguments, we could maintain transportability while assuring ourselves of efficient code. This one example is perhaps trivial but there are many such examples possible and the sum of all is not trivial.

The additional argument in favor of such a standardization of application software is that it has been proven to work. Because of the central role that CERN plays in nuclear and particle physics in Europe, they have been able to set such a standard. To participate in experiments at CERN, as a practical matter, one has to use some software produced at CERN. This software typically expects to have available many subroutines written and optimized for the host computer. The net savings in terms of utilization of computer resources throughout Europe must be very large.

Why doesn't such a standard exist elsewhere? Mainly because of the lack of a focal point which fulfills the role of CERN. It must be the responsibility of those of us involved in this work to identify the need and the possibility of an efficient application software standard. When we then approach the appropriate funding agencies with a plan that will literally save money, it will be their responsibility to support such a plan.

LESTER C. WELCH

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Laser annealing

In your "Search and Discovery" article on laser annealing (July 1978, page 17) the average reader may find it difficult to see the connection between that topic and our previous work on "laser damage in phototransistors" which you mention. Two important phenomena which we demonstrated in those early experiments were production of a molten layer by short intense laser pulses and redistribution of dopant impurity caused by the melting and recrystallization of that layer.^{1,2}



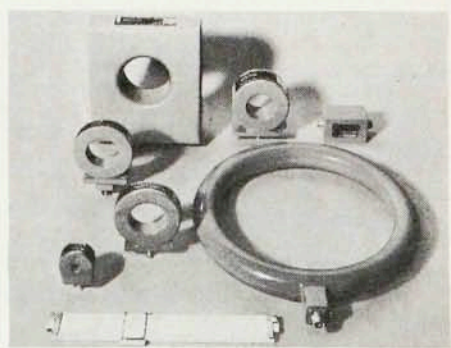
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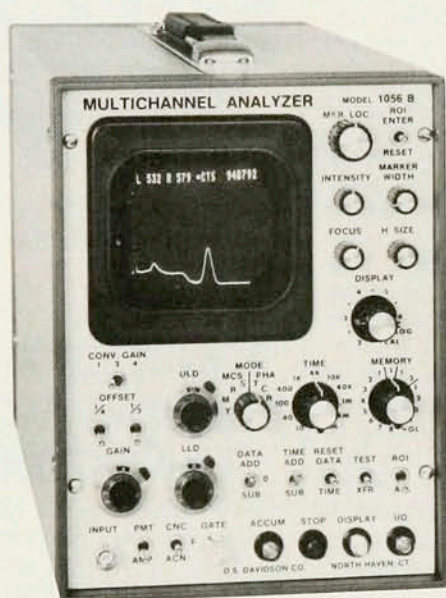
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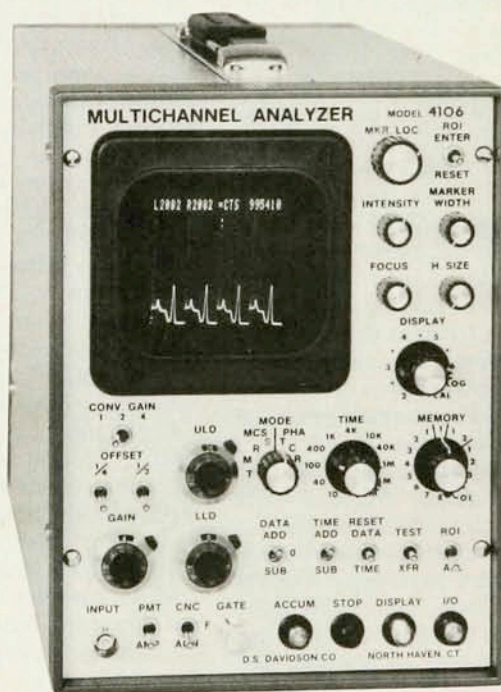
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letters

These are fundamental processes which are involved in laser annealing by the pulse (liquid epitaxy) technique, as well as in laser damage of semiconductor devices.

The redistribution of impurities following pulse melting may have a detrimental effect on a device (as in laser damage), or it may produce a parasitic but tolerable effect (as in pulse annealing of solar cells). It should be pointed out, however, that this effect also offers another means of controlling and modifying impurity distributions,^{3,4} and thus it enhances the potential versatility of laser processing techniques for semiconductor.

References

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2. C. L. Marquardt, J. F. Giuliani, F. W. Fraser, Radiat. Eff. **23**, 135 (1974).
3. C. L. Marquardt, J. F. Giuliani, U.S. Patent 3,940,280 (Feb 24, 1976).
4. C. K. Celler, J. M. Poate, L. C. Kimerling, Appl. Phys. Lett. **32**, 464 (1978).

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7/14/78

Physicist as engineer

The February issue contained two letters which I found particularly interesting. John Fanchi's letter (page 15) concerning vocations vs. avocations and Robert Johnson's letter (page 15) concerning engineering physics both offer excellent alternatives to unemployment for physicists.

I obtained an MS in physics in 1975 and since that time I have been employed as an engineer. My experience has been that an education in physics offers an excellent background for engineering work. The basic understanding of the laws of nature as well as the training that is obtained in logic are both of primary importance in the engineering field. The state boards of registration accept my educational background as suitable for licensing as an engineer and I am eligible this year to take the professional engineer's exam.

I was able to get a job in engineering as a result of some prior experience in the field and an associate degree in engineering from a community college. I did have some difficulty in convincing prospective employers of my ability to perform as an engineer, even though they all agreed that the basic fundamentals of engineering are all founded in physics.

During the time I have spent in engineering, I have not felt handicapped in the slightest by having degrees in physics as opposed to engineering. In some ways, in fact, I have felt ahead of the game.

Programs, such as that outlined at the University of Virginia by Johnson, offer excellent preparation for physics students entering the job market. It is possible at other institutions for students to elect courses in engineering.

All undergraduate physics students should be constantly aware of the fact that they will be seeking employment at some point and they should prepare for this. Some engineering courses as electives will help make a student more employable. Furthermore, engineering or a related technical field is a much better profession than chronic unemployment.

FLOYD M. LOCKAMY

R. J. Reynolds Tobacco Company
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English versus metric

As one who has been a practical builder and experimenter all my life, and has been thoughtful about it,¹ I am distressed to see editorials such as that by Harold Davis (February, page 104), which encourages US conversion to the metric system of measurement, without giving any better reasons than that everyone else is doing it, or that people who know about it like it. There has been growing, if unorganized doubt about the practical utility of the metric system. There seem to be four reasons for adopting the metric system:

► The units can be recovered if they are lost because they are based on the circumference of the Earth.

► Metric arithmetic is easy because units are related by integral multiples of ten.

► The European Common Market uses the metric system.

► The English system is messy.

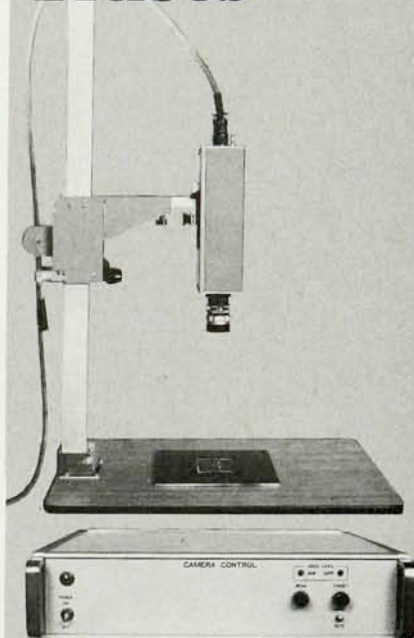
The first reason is weak because other units might be based on the circumference of the Earth, and therefore be recoverable if lost. Other units might be arranged that would share the second advantage mentioned above. The third reason is purely economic and may explain why US industry has been more hospitable to metrication than the general public. But it is not the reason that responsible scientists will want to promote.

Many of my friends, responsible scientists, display some of their most irrational behavior in defending the metric system; and they direct their statements toward the fourth reason in my list, the messiness of English units. Surely the badness of one system is no argument in favor of some other. Further, English units may not be so bad as some critics make them out to be.

The standard foot unit emerged in England as the standard of length from a field of competition which included not only the rod and yard, but also the highly portable cubit, the distance from the elbow to the tip of the outstretched fingers. That the less portable foot would

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Automatic Digitizer for Polaroid Traces



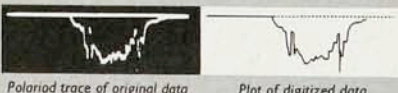
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